

Development of Mathematics Learning Media Based on Discovery Learning Integrated with Inderapura Culture to Improve Mathematical Problem Solving Ability for Junior High School Student of Grade VIII

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Abstract – Based on the preliminary analysis conducted at SMP Negeri 2 Pancung, the students' mathematical problem solving ability was still low. The low ability of students to solve mathematical problems caused by (1) teachers do not use worksheet in the learning process, (2) The learning process that has not facilitated students to construct their own knowledge. Based on this problem, researchers developed mathematical learning media based on discovery learning integrated with Inderapura culture to improve students' mathematical problem solving abilities.

This research was a development research conducted with the Plomp development model. This model was carried out in 3 stages. In the first stage was the preliminary research phase and it was needs analysis, curriculum analysis, student analysis and concept analysis. In the second stage was the development or prototype phase which was designed in accordance with the integrated learning discovery model of Inderapura culture. In the third stage was the assessment phase which aimed to see the effectiveness of learning media by conducting large group field tests. The subjects of this study were the eighth grade students of SMPN 2 Pancung Soal. Data collected by documentation, observation, interviews, questionnaires, and tests. Data from observations, questionnaires and tests were analyzed quantitatively and strengthened by the results of the documentation analyzed descriptive qualitative.

The results showed that mathematics learning media in the form of lesson plan and worksheet based on discovery learning integrated with Inderapura culture for grade VIII in the second semester of Junior High School were produced by fulfilling valid, practical and effective categories. Validity was tested in terms of content, usage, language and graphics. Applicable in terms of application, time, ease of use and effective in terms of potential impacts on students' mathematical problem solving abilities. The conclusion was mathematics learning media was feasible to be used as reference material in mathematics learning, especially materials for constructing flat side spaces in grade VIII of SMP N 2 Pancung.

Keywords – Discovery Learning Integrated With Inderapura Culture, Mathematical Problem Solving Ability.

I. INTRODUCTION

Mathematics learning is a learning process that is applied by the teacher to develop student creativity that can enhance the ability to think, argue, and contribute to solving problems in everyday life. As revealed by the Ministry of National

Education (2006) "One of the goals of learning mathematics is that students have the ability to solve problems which include, understanding problems, designing mathematical models, completing models and interpreting the solutions obtained.

The society's need for understanding mathematics in this globalization era will continue to increase, thus demanding mastery of knowledge and ability to solve problems. In solving these problems students must follow the process to solve the problem. Karatas & Baki (2013) suggested that "Problem solving is recognized as an important life skill involving a range of processes including analyzing, interpreting, reasoning, predicting, evaluating and reflecting". The National Council of Mathematics Teachers (NCTM, 2000) states that "Problem solving is an integral part of all mathematics learning". Problem solving is an important thing in learning mathematics.

Several studies from other countries such as: Pakistan, the Caribbean, Turkey and London revealed that the importance of problem solving skills is so that students in everyday life and in the future are able to apply mathematical concepts. Problem solving abilities encourage students to think for themselves, and remember topics that have been learned to be applied in everyday life (Nasrin et al, 2015; Debora & Michael, 2014; Ufuk & Ahmet, 2019; Jill & Tony, 2015).

The fact is students' mathematical problem solving ability is not good. The low ability to solve mathematical problems of students is seen in one of the schools in Inderapura, namely at SMPN 2 Pancung Soal.

Table 1 Average Score of Daily Tests for Grade VIII Students of SMPN 2 Pancung Soal.

Class	Number of students	Student's passing standard			
		pass $\geq$ 78		Not pass $<$ 78	
		total	%	total	%
VIII.1	29	11	37,93	18	62,07
VIII.2	29	9	31,03	20	68,97
VIII.3	29	10	34,48	19	65,52
VIII.4	29	6	20,69	23	79,31
VIII.5	29	10	34,48	19	65,52
VIII.6	29	10	34,48	19	65,52
VIII.7	29	9	31,03	20	68,97
VIII.8	29	9	31,03	20	68,97

From the table above, it can be seen that from the average daily tests that of grade VIII SMPN 2 Pancung, the questions for the academic year 2020/2021 showed that with the

minimum completeness criteria set by the school, 78 of 232 students and 74 students had achieved results of completeness criteria. The low average of daily repetition of students indicate that the ability to solve mathematical problems of students is also low. It is seen that students do not yet understand the mathematical concepts taught.

Based on the researchers' experience and the results of interviews with several mathematics teachers at SMPN 2 Pancung Soal, it was explained that one of the causes of the students' low mathematical problem solving ability is that teachers do not use worksheet in the learning process, and the learning process has not facilitated students to construct their own knowledge. At the time of teaching, the teacher is not optimal in planning the implementation of the learning process that can encourage students to think and involve students actively.

The success of students in learning is largely determined by the learning tools designed by the teacher. The device commonly used to facilitate students is student's worksheet. But in reality the teacher does not use the worksheet. That is because based on the K13 book given by the department to handle teachers is complete enough for teachers as teaching material in the learning process. Therefore teachers only rely on handbook 2013 curriculum (K13) as teaching material during the learning process. As a result, teaching materials used by teachers in the mathematics learning process do not support students to be active in the learning process. The teacher only uses the 2013 curriculum (K13) mathematics textbooks from the department as a learning resource and there is no worksheet to train students to work on the practice questions in the process of understanding the learning material.

Permendikbud Number 22 of 2016 (2016) explains that the Lesson Plan is a face-to-face learning plan for one or more meetings. Lesson Plan is a realization of the learning experiences of students that have been determined in the syllabus of learning.

Worksheet provides benefits for students to overcome the problems faced in the learning process. Among the benefits of worksheet according to Suyitno (1997) as follows: (1) Activating students in the learning process, (2) Assisting students in developing concepts, (3) Training students in finding and developing process skills, (4) As a guide teachers and students in implementing the learning process, (5) Helping students get notes on the material learned through learning activities, (6) Helping students to add information about concepts learned through systematic learning activities

According to Sanjaya (2013) problem solving can help students to develop new knowledge and be responsible for the learning they are doing. To find out the extent of students' mathematical problem solving abilities, it can be measured by referring to the indicators (Grace, 2015: 85) (a) Identifying the elements that are known, asked and the adequacy of the elements needed, (b) Formulating mathematical problems or compose a mathematical model, (c) Implement strategies to solve problems, (d) Explain or interpret the results of problem solving.

Lesson plan and worksheet are designed using the integrated learning model of Inderapura culture. In discovery learning, students are not only required to master subject matter, but how they can use their potential. The teacher has an active role in determining the problem and the stages of its solution. With this discovery learning learners are more oriented towards guidance and instruction from the teacher so students can understand the concepts of the lesson.

According to Hosnan (2014) the Discovery Learning model is "A model for developing active student learning by discovering on their own, investigating for themselves, then the results obtained will be loyal and long-lasting in memory, not easily forgotten by students". Kurniasih (2014) also states that the Discovery Learning model is "A learning theory that is defined as a learning process that occurs when students are not presented with lessons in their final form, but are expected to students organize themselves".

Bell (in Hosnan, 2014) suggested several specific goals of Discovery Learning, as follows: (1) Students have the opportunity to be actively involved in learning, (2) Students learn to find patterns in concrete and abstract situations, (3) Students learn to formulate strategies question and answer to obtain useful information in the discovery. (4) Learning by discovery helps students form effective ways of working together, (5) Skills, concepts and principles learned through discovery are more meaningful for students, (6) Skills learned in discovery learning situations in several cases are more easily transferred to new activities and are applied in new learning situations.

According to Kurniasih (2014) in applying the Discovery Learning model in class, there are several steps that must be implemented in learning activities, namely: (1) Stimulation, at this stage students are faced with something confusing, then proceed to not member generalization so that the desire to investigate itself arises. (2) Problem statement (problem identification), the teacher gives the opportunity for students to identify as many problems that are relevant to the subject

matter, then one of them is chosen and formulated in the form of a hypothesis (temporary answer to the problem statement). (3) Data collection, when exploration takes place, the teacher gives the opportunity for students to collect as much relevant information as possible to prove whether or not the hypothesis. (4) Data processing, data processing is an activity to process data and information that has been obtained by students either through interviews and observations, then interpreted it. All information from reading, interviewing, observing, etc., are all processed, randomized, classified, tabulated, even if necessary calculated in a certain way and interpreted at a certain level of trust. (5) Verification, at this stage students conduct a careful examination to prove whether or not the hypothesis set earlier with alternative findings, associated with the results of data processing. (6) Generalization (draw conclusions) ", this stage is the process of drawing a conclusion that can be used as a general principle and applies to all events or problems that are the same, taking into account the results of verification.

Along with the development of the times, mathematics grew and developed rapidly in various regions. However, the growth and development of the world of mathematics that occurred in Indonesia in general cannot be equated. This is because of the life challenges facing the people of Indonesia in various regions with different cultural backgrounds. Fitriatien, (2017).

In order that this discovery learning model is more attractive to students and can improve students' mathematical problem solving abilities, this discovery learning model is integrated with Inderapura culture.

This is in accordance with the opinion expressed by Sirate (2012) stating that the teaching of mathematics for everyone should be adapted to their culture, further disclosed by Sembiring in Rachmawati (2010) that mathematics is a construction of human culture. Indicators of problem solving ability used in this study are as follows: (1) understanding the problem, (2) planning a solution, (3) solving the problem according to plan, (4) Re-checking the steps that have been done. (Harris et al: 2014)

Based on the learning stages it is clear that the characteristics of developing learning devices based on discovery learning that are integrated with the valid, practical and effective Inderapura culture can improve the mathematical problem solving abilities of students in grade VIII of Junior High School students.

II. METHODOLOGY

This research was conducted at SMP N 2 Pancung Soal Pesisir Selatan Regency Academic Year 2020/2021. This type of research was research and development. The learning media developed in this study include: Lesson Plan and Student Worksheet for material to enhance flat-sided spaces in grade VIII of Junior High School students.

The development model used is the Plomp model. This model was developed by Tjeerd Plomp. The Plomp model consists of 3 stages, namely the initial investigation phase (preliminary research) by conducting needs analysis (to find out the basic problems needed in the development of learning tools), curriculum analysis, concept analysis, and student characteristics analysis (including cognitive level, age, learning style, and student motivation, so that the resulting learning device is in accordance with the characteristics of students.

The development or prototype phase is carried out by designing learning tools based on discovery learning on flat side space, then self-evaluating by the researcher. Results of the analysis and subsequent revisions were given to five validators (experts review) to be validated. The results of the validation of the learning kit were then revised and once said to be valid then an individual (one-to-one) evaluation was conducted. One-to-one evaluations were carried out by three high, medium and low ability students. Then proceed with the evaluation of a small group (small group) by nine students with toga people with high ability, three people with moderate ability and three people with low ability. Then the assessment phase was assessed in class VIII1 at SMP N 2 Pancung Soal. At this stage, practicality and effectiveness tests were applied.

III. RESULTS AND DISCUSSION

A. Result

The activity of analyzing the characteristics of students in the development of learning devices is an approach that accepts students as they are and makes learning tools that are appropriate to the circumstances of the students. Therefore, the activity of analyzing students is a process to find out the characteristics of students. These characteristics include academic ability, students' fondness for colored teaching materials and the difficulties students often experience in the learning process so that the result is in accordance with the characteristics of the students. Characteristics of students will be very influential in the selection of learning strategies to fit the individual characteristics of students.

The results of the analysis of students conducted as a basic foundation on the development in designing learning tools to be developed. Based on the questionnaire given to students, some information about students can be collected. Based on the answers to the questionnaire, many students said that learning mathematics in class was not fun. Learning in the classroom also does not use worksheet so based on the questionnaire many students answered that the activity sheet is needed in the process of learning mathematics in school. In addition, if you have difficulty in understanding the material students prefer to ask friends or choose to remain silent. Yet according to students they often have difficulty in doing the assignments and examinations given by the teacher.

Based on interviews with teachers, it can also be known the characteristic of students in academic ability of mathematics was still low. This can be seen in the values shown by the mathematics teacher. Also according to mathematics teachers, in the learning process many students do not understand the learning material. This can be seen when students are asked to do practice questions, there are some students who do not do it and prefer to do other activities such as talking to friends, walking in class, and others. When asked to work on problems in front of the class, only a few students want to go to the front of the class, most students refuse because they are afraid of being wrong and do not understand the material being learned. As a result, many students are not active in the learning process in class. For the students' preference for the colored activity sheet which is based on a questionnaire given to students that all students like the colored books or teaching materials.

Based on the analysis of the students, the learning tools that will be developed must support the learning activities of students to be active and be fun so that students get learning experiences that provide opportunities for students to use their abilities in finding and understanding the subject matter so that what is obtained in the learning process will last a long time in students' memories. Therefore, designed learning media that facilitate students to be active in learning is by presenting interesting activities so that students do not get bored following mathematics learning in class.

Discovery-based learning integrated with Inderapura culture is learning that requires students to discover for themselves, investigate on their own and organize the concepts or knowledge they have acquired so as to improve students' mathematical problem solving abilities. The advantages of the Discovery Learning model include (1) The knowledge gained through this method is very personal and powerful because it strengthens understanding, memory, and

transfer. (2) Giving joy to students, (3) student centered, (4) helping students get rid of skepticism, (5) encouraging students to think and work on their own initiative. (6) Encouraging students to formulate their own hypotheses. (7) The situation of the learning process becomes more motivated. (8) The possibility of students learning by utilizing various types of learning resources. (9) Can develop individual talents and abilities.

Students will understand better because students are directly involved actively in developing new knowledge, so they will better remember all concepts and principles. Learning models that directly involve students are effective learning to improve students' mathematical problem solving abilities.

Based on the description of the problems that have been stated, the research was conducted to produce mathematics learning media based on discovery learning integrated with Inderapura culture in grade VIII, semester II, that meets criteria of validity, practicality and effectiveness. The effectiveness of learning media was seen from the mathematical problem solving ability of students. Indicators of problem solving ability that are used are (1) Identifying the elements that are known, asked and the adequacy of the elements needed (2) Formulating mathematical problems or compiling mathematical models (3) Implementing strategies to solve problems (4) Explaining or interpreting the results of problem solving . Learning tools developed are said to be of quality if they meet the valid, practical, and effective criteria. Based on the results of the study, it is known that the mathematics learning media based on discovery learning integrated with Inderapura culture was valid, practical, and effective. The results of each aspect are as follows:

1. The validity of mathematics learning media based on discovery learning integrated with Inderapura culture.

Mathematical learning media based on discovery learning integrated with Inderapura culture in the form of lesson plans were declared valid by the validator as seen from the aspects of the lesson plan components and aspects of learning activities. The average obtained was between 3.4 to 3.8 with a very valid category. Based on these categories, as a whole the aspects of lesson plan got a validity value of 3.55 with a very valid category. This shows that the lesson plan based on discovery learning integrated with Inderapura culture was valid according to experts and can be used in the learning process in the classroom.

For the aspect of presentation of worksheet based on discovery learning integrated with Inderapura culture obtained an overall validity value of 3.37 with a valid category. This means that in terms of presentation, worksheet can already be said to be good and interesting, besides that in terms of time according to the validator the time determined for the work of worksheet based on the discovery learning integrated with Inderapura culture was sufficient. For the feasibility aspect of the contents of the worksheet based on integrated with Inderapura culture obtained an overall validity value of 3.50 with a very valid category. This means that in terms of the material contained in the worksheet was already good and complete according to the validator.

In the graphic aspect of worksheet based on discovery learning integrated with Inderapura culture, the overall validity value was 3.11 with a valid category. This means that in terms of graphics that are in the worksheet it's good according to the validator. For the language aspect of worksheet based on discovery learning integrated with Inderapura culture, the overall validity score was 4 with a very valid category. This means that the use of language in worksheet based on discovery learning integrated with Inderapura culture can be stated to be good and easy to understand.

Based on the categories obtained by each of these aspects, as a whole the worksheet based on the discovery learning integrated with Inderapura culture obtained a validity value of 3.50 with a valid category. This shows that according to experts, worksheet based on discovery learning integrated with Inderapura culture was valid and can be used in the learning process.

2. The practicality of a learning media based on discovery learning integrated with Inderapura culture.

The practicality of the learning kit was seen from the results of the questionnaire analysis filled out by the teacher and students as users. It also can be known from the observation sheet of the learning process. Meanwhile, to see the effectiveness of the device can be seen from the learning outcomes of students after learning to use the device and also the learning activities of students during the learning process.

The practicality questionnaire filled out by the teacher aims to get information about the practicality of the learning device based on the prediction and consideration of the teacher. In general, the results of the practicality questionnaire completed by the teacher can be seen in Table 2.

Table 2. Results of Questionnaire Practicality by Teachers

No	Aspects	Practicality score (%)	category
1	attractiveness	93,75%	Very practical
2	Usage	91,67%	Very practical
3	Simplicity	91,67%	Very practical
4	time	100%	Very practical
5	Equivalent	100%	Very practical
Average of practicality		95,42%	Very practical

Based on table 2 above, it appears that the average practicality value is 95.42% with a very practical category. This means that based on the practicality questionnaire filled by the teacher of learning based on the discovery learning that is integrated with the culture of Inderapura, it has been declared practical.

Practicality questionnaire given to students after participating in the learning process using LKPD based on discovery learning integrated with Inderapura culture. Overall results of the practicality questionnaire filled out by students can be seen in Table 3.

Table 3. Data on the Results of the Practicality Questionnaire by Students in General

No	Aspects	Practicality score(%)	Category
1	Presentati on	85%	Very practical
2	Usage	82,43%	Very practical
3	Legibility	88,23%	Very practical
4	Time	81,9%	Very practical
Average of practicality		84,4%	Very practical

Based on table 3 above, it can be seen that the average practicality value is 84.4% with a very practical category. This means that based on the practicality questionnaire filled out by students after field testing based on the discovery

learning based on discovery learning integrated with Inderapura culture, it has been declared practical.

3. The effectiveness of mathematics learning media based on discovery learning integrated with Inderapura culture.

Based on observations it was that learning mathematic media by using discovery learning was getting better at each meeting. This shows that the implementation of learning by using discovery learning based on discovery learning can work well.

In this study learning outcomes are obtained from the cognitive realm in the form of tests given after the learning process is complete. The test questions were 5 essay questions. Test questions were also a matter of mathematical problem solving ability. The percentage of completeness tests of students' mathematical problem solving abilities can be seen in table 4.

Table 4. Percentage of completeness in Mathematical Problem Solving Ability Tests for Students

	Passing Grade		
	pass	Not pass	Total
Number of students	21	8	29
Percentage	72,4 %	27,6%	100 %

In table 4, the final test of mathematical problem-solving ability shows that students who have reached 72.4%. Students who pass the passing grade is 70%. This means that the mathematic leaning media based on discovery learning integrated with Inderapura culture have been developed effectively.

IV. CONCLUSION

Based on the results of research on development that has been carried out², it can be found several conclusions, namely the mathematics learning media based on discovery learning integrated with Inderapura culture for students of grade VIII in Junior High School that has been developed is valid, practical and effective, and can improve the mathematical problem solving ability of students in grade VIII of SMPN 2 Pancung Soal.

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